

COMPACT FOLDABLE RAMP

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BACKGROUND

Field of the Technology

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This invention relates to ramps for loading and unloading from a first level to a second level and to ramps serviceable as temporary bridges. More specifically, the invention relates to a foldable ramp with successively nesting ramp sections hinged together end-to-end in moving between a compact mobile package and an open operational runway.

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Prior Art

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Loading wheeled vehicles, such as motorcycles, small utility vehicles, and lawnmowers, onto larger vehicles, such as pickups or flatbed trucks have been difficult for some time. Ramps for such loading and unloading of vehicles have been proposed but remain inadequate, typically being inconveniently large and heavy or not conveniently storable away from the truck. Perhaps because of the weight and large folded size, ramps have often been integrated into the vehicle, such as a substitute for or integrated with a truck tailgate.

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Various types of foldable ramps have been disclosed. It is common for sections to be hinged end to end, such as with ramps with two longitudinal sections connected by a transverse hinge folded in face-to-face opposition, as in U.S. Pat. No. 6,009,587 by Beeman and U.S. Pat. No. 4,761,847 by Savage et al. or such as in ramps with more than two sections that fold together in a "Z" or accordion arrangement, such as in U.S. Pat. No. 5,062,174 by DaSalvo and U.S. Pat. No. 4,944, 546 by Keller. These ramps are serviceable but remain unduly

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large and inconvenient to transport. With the accordion style folding, the ramp
2 load capacity is also necessarily limited by whatever mechanism is employed to
keep the upward oriented hinge joint from opening under load. A lightweight
4 portable and compact ramp remains an unresolved requirement.

SUMMARY

6 It is the object of the present invention to provide a portable ramp
particularly suitable as a runway for small-wheeled vehicles such as motorcycles
8 and even wheelchairs and small utility vehicles. (For purposes herein, the term
portable is meant to indicate an ability to be moved independent of a platform to
10 which it may be temporarily connected or associated during use.) It is another
object that the ramp be compact for ease of storage and transport. It is a further
12 object that the ramp be of lightweight design. It is a still further object that all of
the ramp hinge joints be urged into compressive union under load, inherently
14 increasing load capacity.

These objects are achieved in a multi-section ramp hinged longitudinally
16 end to end that uncurls from a portable mode into an arc of hinged sections in
open, or operational mode with longitudinal adjacent section ends abutted at less
18 than 180 degrees. In its folded position, more upper ramp sections nest in
respective adjacent next lower ramp sections, in a stacked nesting configuration.
20 For purposes within, stacked nesting is meant to describe one section within a
second section which in turn is within a third section, etc.

22 The ramp comprises a plurality of sections, typically four, and for ease of
description, the ramp is described as having four sections. However, it should be

understood that the ramp could conceivably comprise more than four sections without deviating from the disclosure of the invention. Such ramps with more than four sections are to be deemed included in this invention.

Each section comprises a runway in the form of a plate with panels on each runway lateral side and with end members on each runway longitudinal end, forming an inverted open box. Longitudinal strengthening ribs run between end members and pass into aligned slots in first and second runway sections so these sections can nest within the larger sections without impacting the longitudinal ribs. Shallow transverse strengthening ribs run between panels, interrupted only by said slots in first and second sections. Thus, all sections fold into close face-to-face, parallel opposition with another ramp section spaced apart from the section runway only by the shallow transverse ribs. The resulting folded ramp then presents a tightly compact, mobile unit easily stored in a small volume and transportable by hand.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is perspective side view of the ramp of the present invention in unfolded, operational position, shown with a pair of wheels on which the ramp can roll when folded. Also shown are two upper sections with slots dividing the sections into section portions, the slots provided to receive strengthening ribs of the lower sections when the upper sections fold compactly into the larger lower sections.

FIG. 2 is a perspective view of the ramp of FIG. 1 folded into a compact portable unit, shown standing on the wheels and the distal end of the last section.

FIG. 3 is an underside view of the ramp unfolded, showing the longitudinal
2 strengthening ribs aligning with slots.

FIG. 4 is also an underside view of the ramp shown with the first section
4 folded against the second section with their runway bottom surfaces nested in
close opposing, parallel disposition, forming a section pair.

6 FIG. 5 is a further underside view of the ramp shown with the section pair
of FIG. 4 rotated against the third section with the first section runway top surface
8 nested in close opposing, parallel disposition to the third section bottom surface,
forming a section trio.

10 FIG. 6 is a still further underside view of the ramp shown with the section
trio of FIG. 5 rotated against the fourth section with the second section runway
12 top surface nested in close opposing, parallel disposition to the fourth section
bottom surface, forming a section quartet.

14 FIG. 7 is a side view of the panel shown slightly unfolded on hinges
between adjacent ramp sections hinged end to end opening downward,
16 illustrating section ends in near abutment that prevents the sections to hinge
open beyond 180 degrees and in fact less than 180 degrees to form an arc that
18 conveys compressive forces to ramp ends under load.

FIG. 8 is a side view of the first section panel.

20 FIG. 9 is a side view of the second section panel.

FIG. 10 is a side view of the third section panel.

22 FIG. 11 is a side view of the fourth section panel.

FIG. 12 is a side view of the panel partially folded illustrating the nature of folding as an approximate curl of the collective panel sections.

FIG. 13a is a plan view of a typical section outer box component showing side panels, end longitudinal end members, and supporting ribs before the panels and end members are folded to form an inverted open box.

FIG. 13b is a plan view of a typical section inner box component showing side panels, end longitudinal end members, and supporting ribs before the panels and end members are folded to form an inverted open box.

FIG. 13c is a plan view of the section outer box component of FIG. 13a a perforated runway.

FIG. 14 is an exploded view of a typical section formed by three component inverted open boxes of FIG. 13a-c, shown with a spacer to establish section slots. For sections without slots, the spacers are omitted and the boxes are assembled side by side.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the figures, and particularly to FIG. 1, the foldable ramp 10 of the present invention comprises a plurality of ramp sections 12, typically four, hinged end to end, disposed such that all adjacent sections rotate on hinges 30 only inward as shown in FIG. 3, that is, with section bottom surfaces 14 rotating toward each other during folding and away from each other during opening, in respective curling and uncurling motions in an approximate spiral path with each more upper section folding first and curling to nest within a larger, next lower

section. So nested, runway top surfaces 15 and bottom surfaces 14 lie in close,
2 parallel opposition.

Each upper section 12u is dimensioned slightly smaller than its next lower
4 adjacent section 12l such that upon folding the upper section 12u with its runway
16, panels, 17, end members 18 and strengthening ribs 20 is nested within the
6 lower section 12l. For ease of description, each section above an adjacent
section is deemed to be smaller than its adjacent lower section. However, It
8 should be understood that it is deemed equivalent to have a lower section
smaller than and folding into a larger adjacent upper section. Also, it is
10 understood that use of terms such "nesting" and "fitting within" and other similar
terms are meant to convey a smaller section fitting within the another section into
12 which it nests; that is between the lateral side panels and longitudinal end
members and in close face-to-face opposition to the underside of each section
14 runway. It does not necessarily require that those side panels and/or end
members extend from the respective runways beyond an inner section nested
16 within.

The ramp sections 12 open fully to an operational mode with adjacent
18 section longitudinal end members 18 abutting, inherently preventing adjacent
sections from opening beyond 180 degrees. Section end members fold from
20 runway 16 at less than 90 degrees so that end members 18 of adjacent sections
12u and 12l abut face to face with their respective runways meeting at less than
22 180 degrees creating an arc along the ramp runway. Thus, under load the ramp

section end members 18 abut under compressive forces, urging them together
2 with stability increasing under increasing load.

The ramp sections 18 are strengthened by the side panels 17 (shown in
4 FIG. 8-11) depending vertically downward from the section runway 16 along each
section lateral side 22 and longitudinal strengthening ribs 20 running
6 longitudinally between section longitudinal ends 24, between and parallel to side
panels 17. Shallow transverse strengthening ribs 26 extend between panels 17
8 and longitudinal strengthening ribs 20 and between pairs of strengthening ribs
20.

10 Turning to the hinges 30 and referring primarily to FIG. 1 and FIG. 12, it is
helpful to describe the hinge configuration in relation to upper and lower adjacent
12 sections 12u and 12l. It has been described that for each pair of adjacent
sections, one will be smaller than the other so that the smaller can nest within the
14 larger. Consistent with the assumed nomenclature herein, in describing the hinge
30, the smaller adjacent section will be referred to as the upper section 12u and
16 the larger adjacent section will be referred to as the lower section 12l. Similarly,
an upper element will indicate in the direction of the smaller section and a lower
18 element will indicate in the direction of the larger element. Continuing, hinge ears
32 on lower ends 34 of each of the side panels 17 and lower ends 36 of the
20 longitudinal strengthening ribs 20 (except the last or lowest section) extend below
and beyond an upper section 12u reaching under the adjacent lower section 12l.
22 A hinge plate 36 extends vertically downward under the runway lower surface
16a of the lower section 12l inward from a lower section end member 18 on a

lower section first end 38. A hinge bar 40 passes through a hinge plate hole 42
2 aligned with a hole 44 in the hinge ear 32 on each section lateral side 22 forming
the hinge 30 between the adjacent upper and lower sections 12u and 12l,
4 longitudinally. Thus, when the upper section 12u pivots on the hinge 30, it folds
fully under the adjacent lower section 12l, inward of the lower section end
6 member 18.

As also shown in FIG. 3, ramp hinges 30 between adjacent sections 12u
8 and 12l are below the ramp runway 16 enabling the ramp 10 to fold in the
general nature of a crude spiral path 46 as shown in FIG. 12. With ramp hinges
10 30 below the abutting end members 18, load forces are absorbed as
compressive forces through the abutting member ends 18 and the ramp load is
12 transferred to ramp end members 18 largely as if the ramp were a single unit.
Beyond the abutting sections, the ramp load limit is derived from the stress
14 transferred to the ramp hinges 30 located below the abutting end members 18. It
is understood that as compressive forces act at the abutting end members,
16 tension forces act below those end members, which are absorbed by the hinge.
Provided the sections have sufficient support strength greater than the hinge
18 strength, the ramp load capacity is then limited only by the hinge strength.

To accommodate longitudinal strengthening ribs 20 as the two upper most
20 sections 121 and 122 nest together, the rib ears 32 of the upper most, or first,
section 121 connect pivotably to the hinge bar 40 outside of the ears 32 of the
22 next lower, or second, section 122, also folding together in face-to-face
opposition in scissor-like fashion. The scissor-like closing of the strengthening

1 ribs 20 and panels 17 assures that the sections 12 do not bind during folding but
2 remain fully aligned. Respective side panels 17 of nesting sections slide in
scissor-like fashion into opposing face-to-face disposition with the runway bottom
4 surface 14 of the two sections also in opposing close parallel face-to-face
disposition.

6 The two upper sections 121 and 122, or first and second sections, rotate
on their hinge 301 into a folded configuration with their runway bottom surfaces
8 141 and 142 in close parallel opposition forming a section pair 52, as shown in
FIG. 4.

10 In continuing the compact folding process, as shown in FIG. 5, the section
pair 52 pivots as a unit on the next lower hinge 302, between the second and
12 third sections 122 and 123, such that the pair 52 nests into the third section 123
(counted from the top, or smallest section) with the first section runway top
14 surface 151 folding into face-to-face opposition and parallel to the third runway
bottom surface 143, forming a trio 54 of sections with the third section panels 173
16 and member ends 183 around the section pair 52. In thus folding into the third
section 123, the panels 172 of the second section 122 fold in scissor-like fashion
18 into face-to-face opposition with the panels 173 of the third section 123.

To accommodate the ribs 203 of the third section 123 as the section pair
20 52 nests into the runway underside 143 of the third section 123, the first section
runway top surface 151 includes longitudinal slots 601 aligned with the ribs 203
22 of the third section 123 such that as the section pair 52 rotates into its fold

position, nesting within the third section side panels 173 and end members 183,

2 the third section ribs 203 move into the first section slots 601.

Further in continuing the compact folding process, as shown in FIG. 6, the
4 section trio 54 pivots as a unit on the next lower hinge 303, between the third and
fourth sections 123 and 124, such that the trio 54 nests into the fourth section
6 124 with the upper runway surface 152 of the second section 122 folding into
face-to-face close parallel opposition to the runway bottom surface 144 of the
8 fourth section 124, forming a section quartet 56 with the fourth section panels
174 and end members 184 around the section trio 56. As before, the panels 173
10 of the third section 123 fold in scissor-like fashion into face-to-face opposition
with the panels 174 of the fourth section 124.

12 In similar manner as above, to accommodate the ribs of the fourth section
124 as the trio 56 nests into the underside 154 of the fourth section 124, the
14 second section runway top surface 152 includes longitudinal slots 602 aligned
with the longitudinal ribs 204 of the fourth section such that as the trio 56 rotates
16 into its fold position, nesting within the fourth section side panels 174 and end
members 184, the fourth section ribs 204 move into the second section slots 602.

18 As shown in FIG. 3, the slots 601 and 602 of the first and second sections
comprise strengthening ribs 201 and 202 on each side of the section slots,
20 respectively. Thus the slots divide these sections into three section portions 12a,
12b and 12c with a central portion 12b separated from the outer portions 12a and
22 12c by a spacer 12d on the hinge bars 40 between central and outer sections on
each section end that defines the slot 60 by separating the section portions, as

further illustrated in FIG. 14. The inner portion 12b may comprise a porous plate
or a mesh 12e to minimize weight of the section runway while still
accommodating riding of a wheeled vehicle thereon, such as a motorcycle. The
outer section portions 12a and 12c may comprise a solid plate 12f that facilitates
a person safely walking alongside the motorcycle.

As shown in FIG. 14, the sections may comprise inverted open boxes 70
as section components. Longitudinal ends 72 of boxes 70 collectively comprise
section end members 18. Outer lateral sides 74 of outer boxes 70o comprise
section panels 17. Inner lateral sides 76 of boxes 70 form section longitudinal
strengthening ribs 20. With the boxes 70 spaced apart by spacers 12d they form
section slots 60. When assembled together without spacers, adjacent box sides
together form a single longitudinal rib 20.

In folded configuration, the two lowest and largest sections 123 and 124
thus enclose the remaining smaller sections 121 and 122 nested between them.
A wheel 80 on the upper end 82 of each panel 17c of the third, or next to last
section 123 enables the folded unit to conveniently roll. The pivot bar 40
between the last two sections 123 and 124 serves as a convenient handle in
directing the folded unit on its wheels. Further, the distance of the pivot bar 40 to
the wheel contact with the ground is equal to that distance from that pivot bar 40
to the last section distal end 84 such that the folded unit stands supported on one
side on the wheels 80 and on the other side on the last section distal end 84.